# LTE RF Engineering Training

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LTE RF Engineering Training Course Program, a strong understanding of RF engineering fundamentals is required to optimize the performance of LTE networks.

LTE communication technology is rapidly evolving and wireless devices and components are practically found in everything we are doing today. LTE RF engineering covers all the RF capabilities needed in design sophisticated LTE RF circuits and components.

Our LTE RF engineering training program provides the engineering and non-engineering professional with the LTE technological advances in both the commercial and military arenas. You will learn the fundamental principles of LTE, MIMO, RF systems, the design of practical and cost effective LTE RF subsystems, and integrated circuits or full LTE RF systems. Learn the key concepts of planning, analyzing, modeling, simulating, design, implementation, integration testing, verification and validating RF systems related to LTE and LTE-Advanced.

LTE RF engineering training covers the basics of RF principles, physical laws and applications.

Learn the basics of RF devices and building blocks used in the design of LTE and LTE-A RF communication systems. Learn the engineering principles of LTE RF communication link, RF budget, LTE RF components in LTE mobile devices, sensors and other critical subsystems.

Designed for engineers, technicians, project managers and any other personnel involved in planning and/or decision making process regarding real-life RF engineering related to LTE network build-out.

Topics Covered (can be customized):

- LTE Systems Engineering Principles
- LTE RF Principles and Applications
- Principles of OFDMA, SC-FDMA and MIMO
- LTE Design and Applications
- LTE Cell Planning Principles
- LTE Link Budget Calculation
- LTE Transmission and Backhauling Engineering
- Antenna Theory and Design
- LTE M2M, IoT and Remote Sensors
- LTE Test & Measurement
- RF System Design for LTE and LTE-A Communications
- LTE RF Circuit Design
- LTE RFIC Design
- Software Defined Radios (SDR) Applied to LTE

# LTE RF Engineering Training Course Outline

### LTE Systems Engineering Principles

- Foundations of System Engineering
- LTE standards, architectures, and processes
- LTE system requirements
- LTE systems management
- LTE system functional analysis
- LTE system analysis of alternatives
- LTE decision making and support
- LTE operational analysis
- Engineering principles of complex LTE systems
- LTE system development process
- LTE system engineering management
- LTE system engineering development stages
- LTE system Integration and evaluation
- LTE operation and support

### LTE RF Principles and Applications

- LTE RF environment
- LTE frequency bands
- Propagation principles of LTE
- LTE antennas
- Scattering parameters in LTE radio
- LTE system active and passive components
- Analysis of low noise high power amplifiers for LTE
- LTE modulation and demodulation techniques
- LTE circuits
- LTE receiver/transmitter characteristics
- Transmission lines

### Principles of OFDMA, SC-FDMA and MIMO

- LTE air interface
- LTE Multiple Access principles
- OFDMA basics
- SC-FDMA basics
- MIMO basics
- MU-MIMO principles

**LTE Design and Applications**

- Implementation of LTE RF circuits
- LTE Integrated Circuit (IC) configurations
- LTE passive components
- LTE low noise amplifiers and mixers
- LTE IC packaging and testing
- LTE transceiver architectures

**LTE Cell Planning Principles**

- LTE radio propagation fundamentals
- LTE frequency planning and management
- LTE cell planning tools and procedures
- Uplink vs. downlink coverage analysis
- LTE traffic engineering
- LTE capacity planning and management
- LTE RF optimization principals
- LTE cell planning KPIs

**LTE Link Budget Calculation**

- What is link budget?
- Typical link budget elements
- LTE link losses and gains from the transmitter
- Channel losses, Path loss
- Range
- Transmitter output power
- How much sensitivity do we need?
- Gains
- Transmit antenna gain
- Receive antenna gain
- Receiver noise power
- Link margin
- Variations on the basic link budget
- LTE Sample Link Budget

**LTE Transmission and Backhauling Engineering**

- LTE transmission network design, planning and implementation
- LTE link engineering
- LTE network performance and reliability issues

- LTE link protection
- Project management and logistics
- LTE deployment challenges

**LTE Antenna Theory and Design**

- Principles of electromagnetic radiation fields
- Antenna fundamentals
- Various antennas in LTE deployment
- Application of antennas in communication links

**LTE M2M, IoT and Remote Sensors**

- M2M basics
- IoT basics
- Remote Sensors applications
- Surveillance, tracking and target detection systems
- Commercial and military grade
- Passive and active sensors
- Sensor system technologies and LTE
- Comparison to microwave/millimeter-wave Radar
- Electro-optical and Thermal imaging systems

**LTE Test & Measurement**

- Introduction to RF/LTE parameters
- Measurement principles and test techniques
- LTE test and measurement methods and equipment specifications
- LTE simulations software based tools
- LTE network and spectrum analysis

**RF System Design for LTE and LTE-A**

- Characteristics and benefits RF systems in LTE applications
- LTE system blocks and functions
- LTE system architecture requirements
- Calculation of critical system characteristics
- LTE sensitivity requirements
- System response
- Effect of temperature changes
- LTE system measurements
- LTE RF circuit design

- LTE passive and active components
- Basic impedance matching; S-parameters
- Stability prediction
- LTE amplifier design
- Coupling structures
- Filters and mixers
- Non-linearity and its effects
- LTE transceiver architectures
- Design tradeoffs between various blocks in a system

**Software Defined Radios (SDR) in LTE**

- What is SDR?
- Software aspects of SDRs
- LTE SDR applications
- SDR current developments and implementations
- Benefits and challenges of LTE SDR development and deployment